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## COMPLETE SPECIFICATION.

## Improvements in or relating to Steering Gear for Motor Road Vehicles.

We, JOHN WOOLER, of Willow Bungalow, West End Lane, Ruislip, Middlesex, and WILLIAM JOHN BALFOUR-MURPHY, of 42, Langley Park Road, Sutton, Surrey, both British Subjects, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following 10 statement:—

This invention relates to steering gear for motor road vehicles, and has for its object to provide an efficient steering gear of a simple construction.

15 According to the present invention, the vertical steering swivel pins carrying the axle of each road steering wheel are actuated through arms secured thereto, by means of cross rods connected to the 20 arms and to a slideable toothed sleeve, the toothed sleeve being operated by a pinion on the inner steering column carrying the steering hand wheel, spring means being employed whereby the arms and cross 25 rods as also the cross rods and the toothed sleeve can automatically adjust themselves for wear or shock, and means may also be employed in connection with the inner steering column and bearing 30 whereby adjustment between the teeth of the slideable sleeve and the toothed pinion can be effected, the whole of the steering gear being enclosed within a casing carried by the framework supporting the 35 steering swivel pins.

The invention will be clearly understood from the following description aided by the annexed drawings in which:—

40 Figure 1 is a side view of the front part of a motor road vehicle partly broken, and shows the steering gear applied to vertical steering swivel pins which are secured to the upper bracket of spring suspension mechanism pivotally 45 carried by the underframe of the vehicle.

Figure 2 is a plan view of the under-frame of the vehicle as shown at Figure 1 with the steering gear applied.

45 Figure 3 is a sectional view through 50 the steering box.

Figure 4 is a cross sectional view broken through the steering box, one side of the supporting casing, and side box [Price 1/-]

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carrying the vertical steering swivel pin and steering arm.

Figure 5 is a plan view of the steering box, and one side of the supporting casing, the side box being in section.

Figure 6 is a sectional under plan of the steering box and a portion of the supporting casing.

Figure 7 is a detail view of the tubular toothed sleeve.

Figure 8 is a detail sectional view through the side box to show the vertical steering swivel pin and steering arm.

Figure 9 is a front view and Figure 10 a part sectional front view of the steering box to show the adjustable end bearing of the inner steering column.

Figure 11 is a detail sectional view of a portion of the steering box to show the adjustable end bearing of the inner steering column.

According to the construction of the vehicle suspension shown at Figures 1 and 2, the steering cross supporting casing A is carried at each side by vertical steering swivel pins 12, 12 secured to the top brackets 13, 13 of the spring suspension means 14, 14 carrying the front road wheels 15, 15 of the vehicle 16.

The spring suspension means are pivotally carried at their lower ends by brackets 17, 17 secured to the side members of the underframe 16<sup>a</sup> of the vehicle 16 whereby the spring suspensions 14, 14 together with the road wheels 15, 15 are capable of being moved about their vertical axis, and bracing members 18, 18 are employed at each side, secured to the underframe 16<sup>a</sup> and to the cross supporting casing A at a point 19 whereby the spring suspensions are also supported at their upper ends.

In carrying out the invention the steering cross supporting casing A consists of two end boxes 20, 20, which are carried by framework supporting the vertical steering swivel pins 12, 12 with suitable combined ball and thrust bearings 20<sup>b</sup>, 20<sup>a</sup> positioned in hollow bosses 21, 21 formed in the lower parts of the side boxes, whereby the swivel pins 12, 12 are free to move within the side boxes about their vertical axis.

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The side boxes 20, 20 are preferably made in two halves secured together by screws 20<sup>b</sup>.

Positioned in tubular portions 22, 22<sup>5</sup> of the side boxes 20, 20 and extending across the vehicle underframe 16<sup>a</sup> are cross tubes 23, 23, these tubes at their inner ends 23<sup>a</sup>, 23<sup>a</sup> being screw threaded and screwed into tubular extensions 24<sup>a</sup> 10 24<sup>a</sup> of a steering box 24 to hold the tubes securely to the steering box 24. The steering box 24 is formed with a hollow tubular portion 24<sup>b</sup> in line with the cross tubes 23, 23 and positioned within this 15 tubular portion 24<sup>b</sup> is a slidable tubular toothed sleeve 25.

The steering box 24 is formed with another tubular portion 24<sup>c</sup> positioned at right angles to the tubular portion 24<sup>b</sup>, 20 and preferably on the under side of the portion 24<sup>c</sup> with the bores communicating and one end 24<sup>d</sup> of this tubular portion 24<sup>c</sup> is screwthreaded and carries the outer steering column 26 which is 25 screwed into the screwthreaded end 24<sup>d</sup> of the tubular portion 24<sup>c</sup> and securely held thereto by a locking nut 27. In the other end 24<sup>e</sup> of this tubular portion 24<sup>c</sup> is positioned a flanged bearing bush 28, the flange 28<sup>a</sup> being next to a flange 24<sup>f</sup> on the tubular end 24<sup>e</sup>.

Positioned within the outer steering column 26 and carried by the flanged bearing bush 28 and a bearing bush (not shown) at the steering hand wheel 29 end of the outer column 26, is the steering inner column 30 which carries the steering hand wheel 29, and the steering inner column 30 is provided with a toothed pinion 31 at a point within the tubular portion 24<sup>c</sup> which meshes with the toothed sleeve 25 positioned in the steering box 24.

The inner column 30 is formed tubular 45 so as to allow the control mechanism for the hand operation of the magneto, carburetter, electric horn to be passed through it.

The flanged bush 28 in the steering box 50 is of the adjustable type and as shown on the drawings, consists of an eccentric bush 28 capable of being rotated sufficient to allow of any slack movement between the toothed pinion 31 and the toothed sleeve 25 being taken up i.e. the inner column 30 together with the toothed pinion 31 can be moved towards or away from the sleeve 25, if necessary, to provide for the correct adjustment or mesh 60 of the teeth. The adjustment of the eccentric bush 28 is carried out by providing the flange 28<sup>a</sup> with a projection 28<sup>b</sup> capable of being acted upon and moved within a slot 32 formed in the flanged end 24<sup>f</sup> of the tubular end por-

tion 24<sup>e</sup> by an adjustment screw 33 carried by a boss 34 formed on the flange 24<sup>f</sup> of the tubular end portion 24<sup>e</sup>.

Means for locking the eccentric bush 28 in the placed position after adjustment, are provided, and consists of providing the flanged end 24<sup>f</sup> of the tubular portion with screwed studs 35, 35 projecting through arcuate slots 36, 36 in the flange 28 of the eccentric bush 28, the studs 35, 35 having nuts 37, 37 which when tightened up securely hold the flanges 24<sup>f</sup> 28<sup>a</sup> together and prevent movement of the bush 28.

The toothed sleeve 25 is connected by cross rods 38, 38, to steering arms 39, 39, fixedly secured by cotter pins 40, 40 to the vertical swivel pins 12, 12, the steering arms 39, 39 being positioned within the end boxes 20, 20 and on any movement of the steering hand wheel 29 to rotate the inner column 30, will through the toothed pinion 31 impart end on movement to the toothed sleeve 25 and through the cross rods 38, 38, move the steering arms 39, 39, whereby the vertical swivel pins 12, 12 carried by the front wheels suspension means 14, 14 are moved about their vertical axis to allow the road wheels 15, 15 to move in unison 95 to effect the steering.

The cross rods 38, 38 which are preferably tubular in section are each connectable to the toothed sleeve 25 by spring loaded ball and socket joints, and a convenient method and as illustrated on the drawings and with special reference to Figures 4 and 7, consists in providing each of the inner ends of the cross rods 38, 38, with an internal screwthreaded portion 38<sup>a</sup> in which is screwed a rod 41 having a ball end 41<sup>a</sup> projecting to within the sleeve 25, the rod 41 being provided with a locking nut 42 to lock the ball ended rod 41 to the cross rod 38.

Each ball end 41<sup>a</sup> of the rod is held to the tubular sleeve by being positioned between two cup shaped members 43, 44, as bearings, with a short stiff helical spring 45 interposed between the inner 115 cup members 43, 43, and the outer ends of the tubular sleeve 25 are internally screwthreaded for receiving screwed sockets 46, 46, which when screwed into the sleeve press against the outer cup members 44, 44, to securely hold the ball ended rods 41, 41 to the sleeve 25 but allow of a slight movement of the side rods 38 within the limits allowed by the spring 45 when thrust movement is 120 applied to either of the side rods due to shock on the road wheels, thereby preventing such being transmitted to the steering hand wheel, and any slack movement due to wear between the ball ends 125 130

+1" and the cup member 43, 44 is automatically compensated for by the action of the spring 45 positioned between the inner cup members 43, 43. Locking washers 47 are provided in connection with the screwed sockets 46 to ensure that the sockets are securely held to the sleeve 25.

The other or outer ends 38<sup>b</sup>, 38<sup>b</sup> of the cross rods 38, 38 are connected to the steering arms 39, 39, by spring loaded ball and socket joints, and each of the free ends of the steering arms 39 is provided with a ball head 39<sup>a</sup> which is positioned between cup members 48, 49 carried by the swaged out ends 38<sup>b</sup> of the cross rods 38, the ends of the cross rods 38 being screwthreaded internally and provided with screwed plugs 50 with springs 51 interposed between the plugs 50 and the outer cup member 49, the springs automatically compensating for any slack movement due to wear between the cup members 48, 49 and the ball head 39<sup>a</sup> of the arm 39. Slotted holes 52 are formed in the ends 38<sup>b</sup> of the side rods through which the ball heads 39<sup>a</sup> of the arms 39 can be passed and to allow movement when the relative angle between the arms and the side rods is altered during their movement.

Adjustment of the cross rods 38 to ensure correct tracking of the front road wheels is provided for by the screwed ends of the ball ended rods 41 screwing into the screw-threaded portion 38<sup>a</sup> of the cross rods, and after this adjustment the locking nuts 42 ensure the rods 41 and cross rod 38 are securely held together.

The steering mechanism which is enclosed, can be effectively lubricated by oil which is retained within the cross supporting casing A and steering column 26. The rake of the steering column 26 is also easily adjustable and to effect this adjustment the screws 20<sup>b</sup> holding the halves of the end boxes 20, 20 together are first slackened off when the cross tubes 23, 23 together with the steering box 24 and steering column 26 are moved about the axial line of the cross tubes 23, 23 the required amount, and the screws 20<sup>b</sup> tighten up to clamp the ends of the cross tubes 23, 23 in the tubular portions 22, 22 of the side boxes 20.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Steering gear for motor road vehicles, comprising arms on the vertical steering pins carrying the axle of each road steering wheel; a cross rod connected to each arm at one end and to a

slidable toothed sleeve at their meeting ends, a pinion on the inner steering column carrying the steering hand wheel and engaging the slidable toothed sleeve, spring means engaging the meeting ends of the cross rods and spring means engaging the other ends of the cross rods and the arms on the vertical steering pins, the whole being enclosed in a casing carried by the framework supporting the steering swivel pins. 70

2. In steering gear for motor road vehicles, as claimed in claim 1, a flanged eccentric bush carried on the end of the inner steering column and positioned in the casing and held thereto, but capable of rotary adjustment to determine the degree of mesh between the toothed pinion and toothed sleeve. 80

3. Steering gear for motor road vehicles, comprising an arm on each vertical steering pin carrying the axle or each road steering wheel; a cross rod adjustable as to length connected to each arm at one end and at their meeting ends to a slidable toothed sleeve positioned in a steering box connected by tubes enclosing the cross rods to side boxes containing the arms and carried by the framework supporting the vertical steering pins; a ball head at the meeting end of each cross rod each ball head being carried in cup shaped bearings in the slidable sleeve and held thereon by a coiled spring positioned between the bearings, a toothed pinion carried by the inner steering column and positioned in bearings in the steering box and engaging the teeth of the slidable sleeve; a tubular portion on the outer end of each cross rod engaging a ball end of each arm, such ball end engaging a bearing on the inner side of the cross rod and controlled by a spring positioned on the other side of the ball, the spring being 95

adjustable as to tension. 100

4. In steering gear for motor road vehicles as claimed in claim 3, positioning the end of the inner steering column in a flanged eccentric bearing bush carried in a bearing on the steering box, the flange having a projection on one side engaging a recess in a flange on the box surrounding the bush bearing and arcuate slots for engaging projecting 115 screwthreaded studs on the steering box; a boss on the box having a screw pin for engaging the projection on the bush for adjusting the bush to determine its position according to the degree of mesh 120 between the pinion and the toothed sleeve and nuts on the screw studs to lock the bush in the adjusted position. 125

5. Constructing steering gear for motor road vehicles substantially as 130

described and as shown on the annexed drawings.

Dated this 14th day of December, 1933.

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Fig. 1.

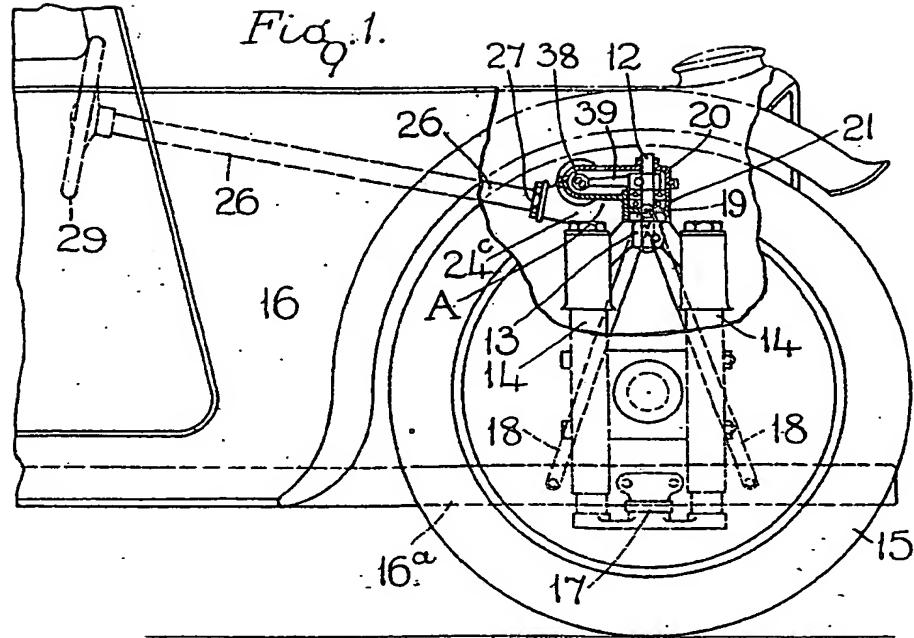
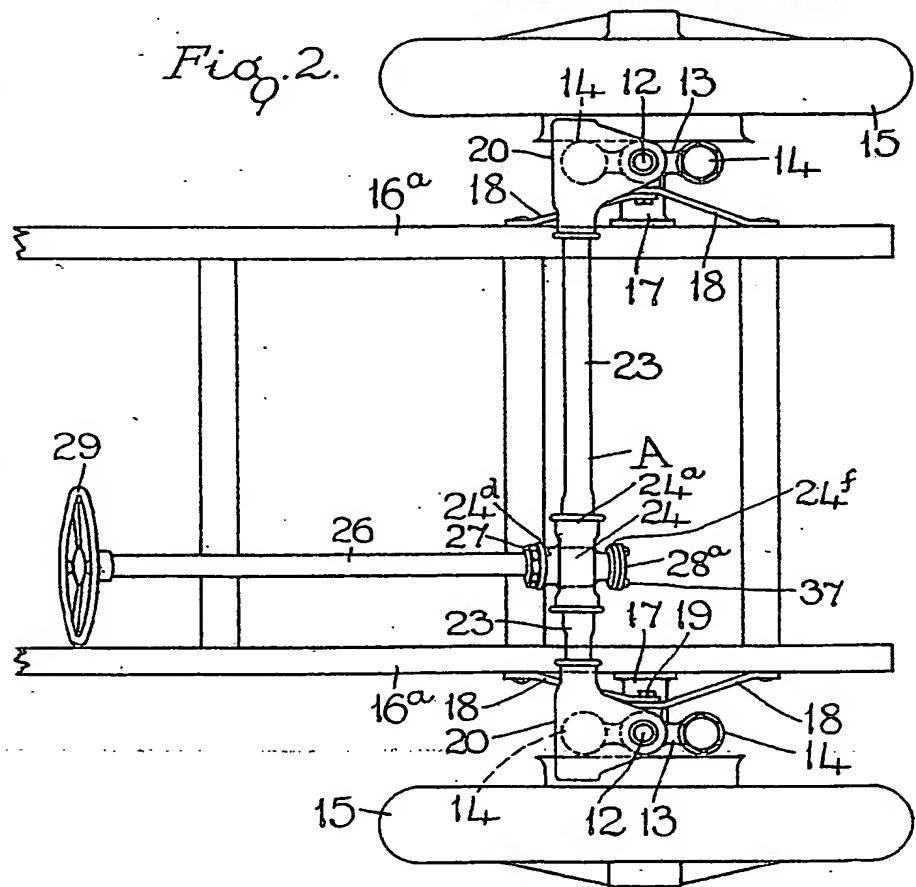
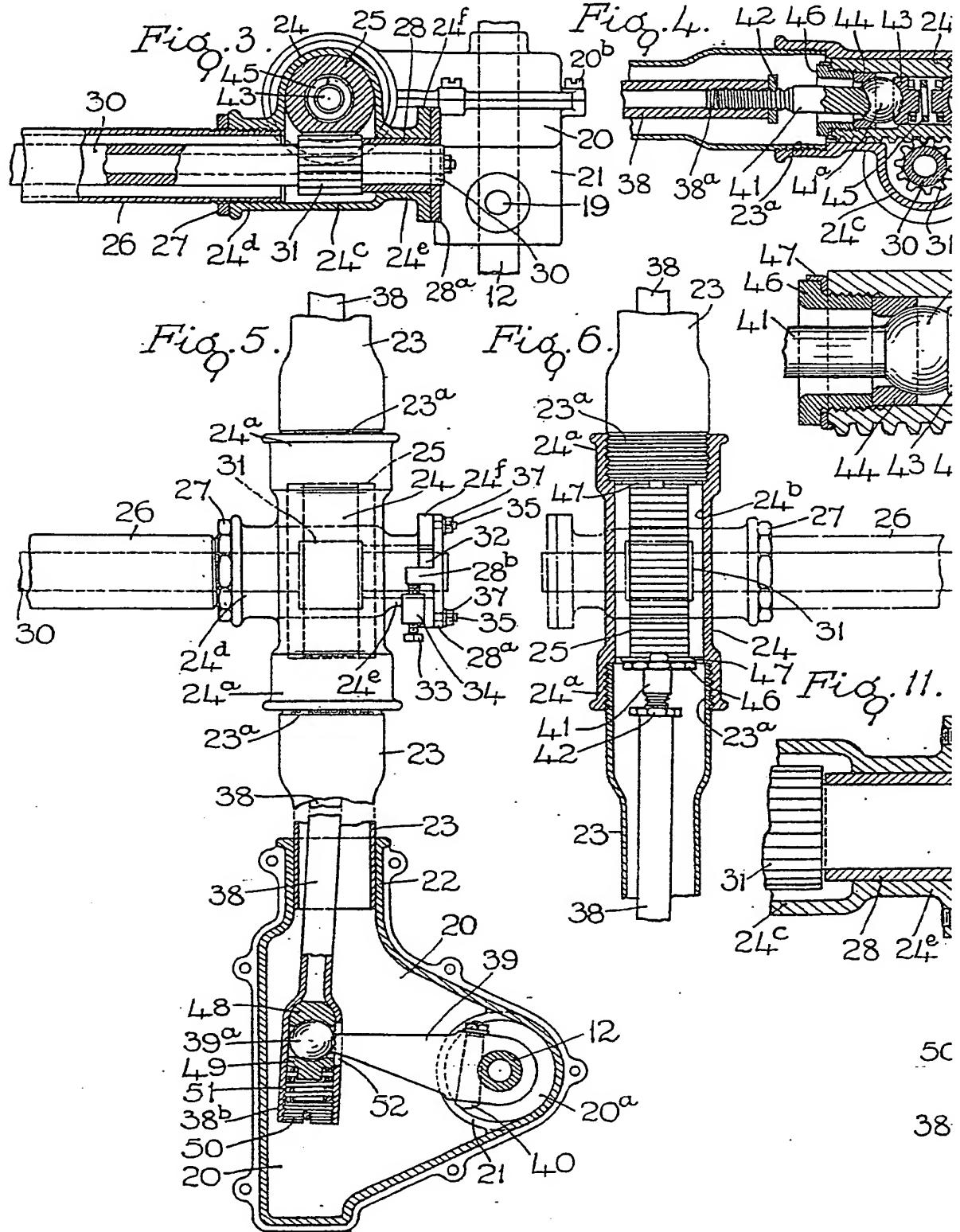


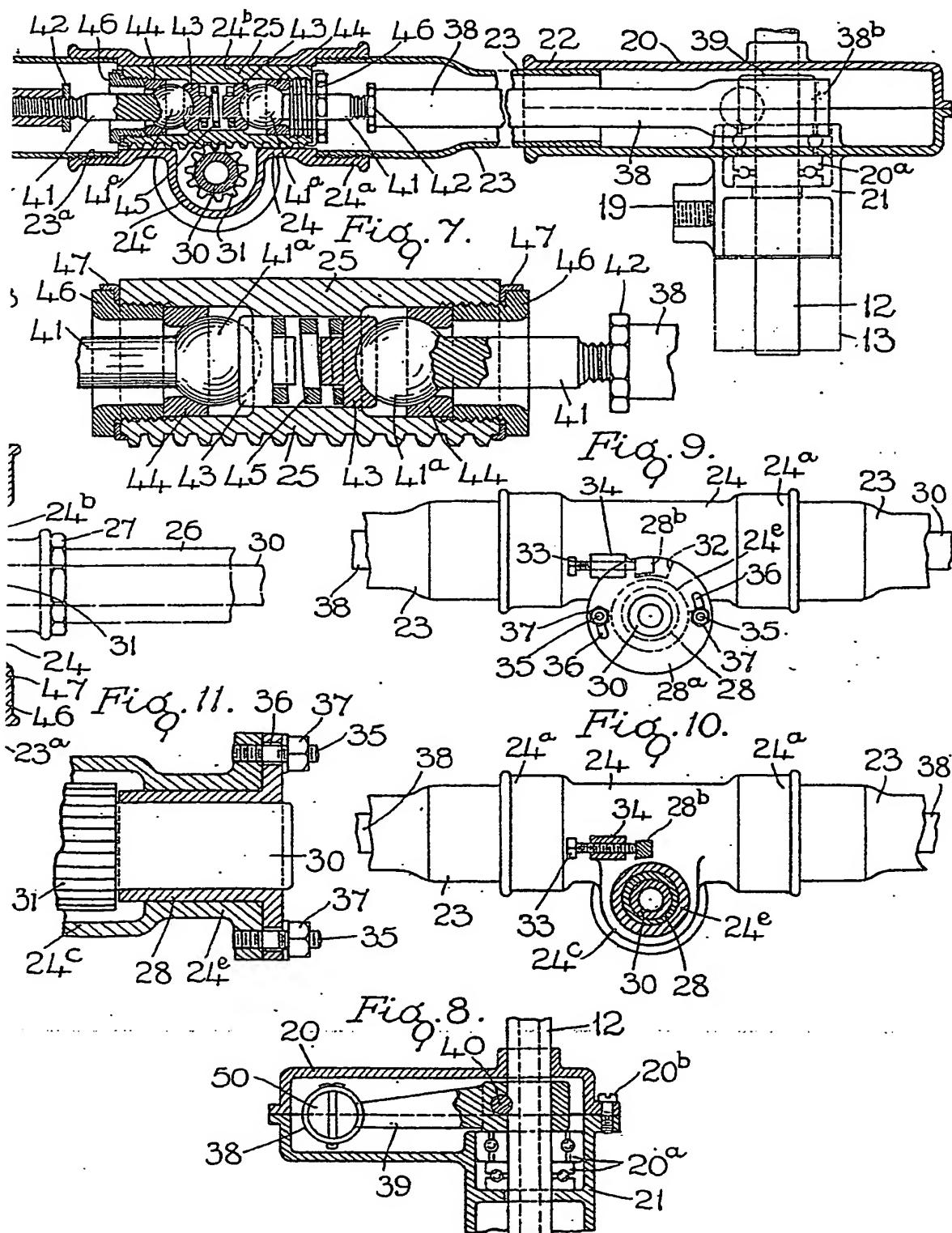
Fig. 2.

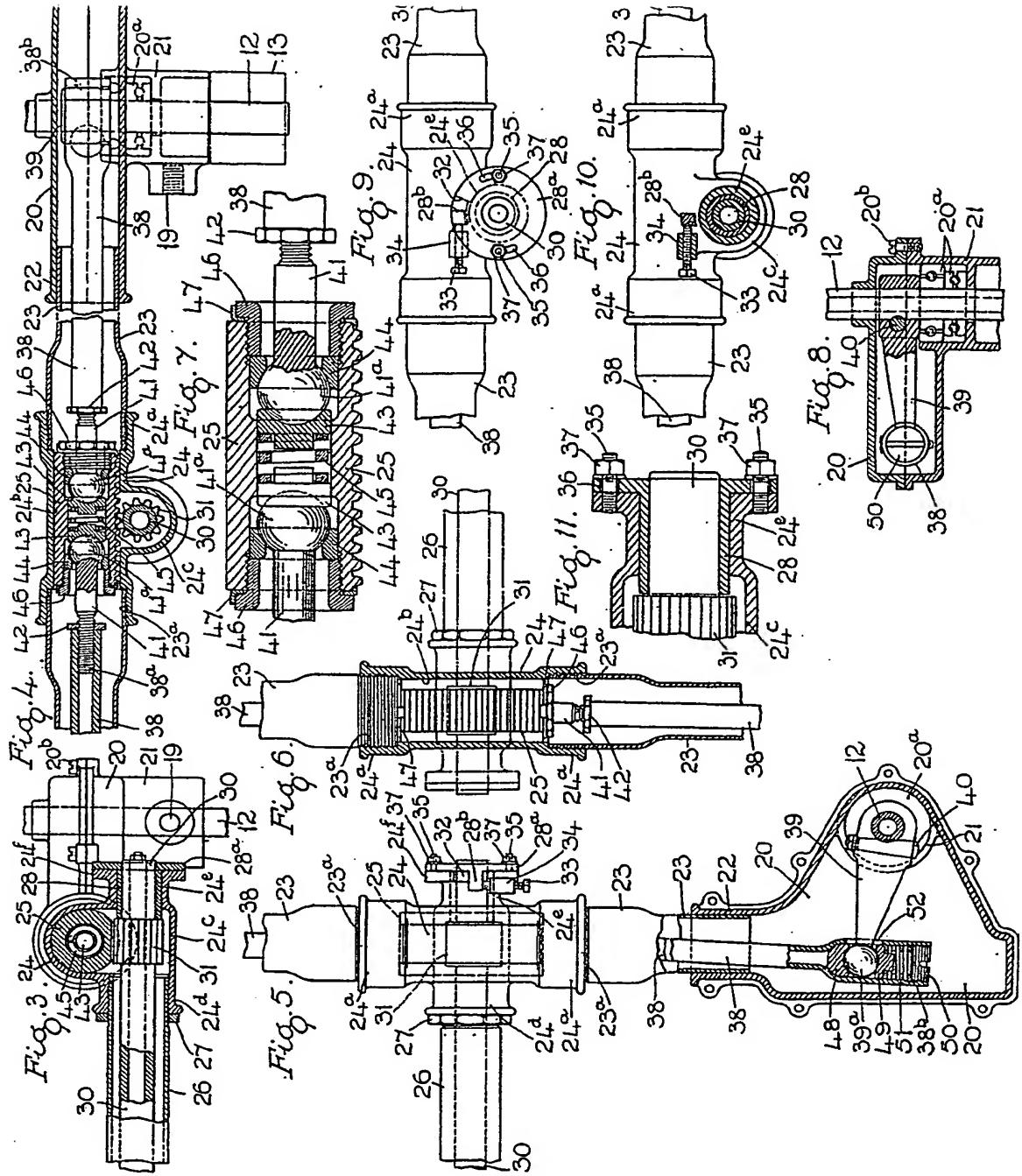


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